

Summary of Ozone Monitoring Data in the Lake Michigan Region:

1999 – 2001

**Lake Michigan Air Directors Consortium
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The purpose of this document is to present the ozone air quality monitoring data for the period 1999 – 20001 for sites in the Lake Michigan area. There are 45 ozone monitors located in the nonattainment counties in northwestern Indiana (6), northeastern Illinois (23), and eastern Wisconsin (16) – see Figure 1 and Appendix A. In addition, there are 26 more ozone monitors located in other counties in the Lake Michigan area (i.e., 6 in northwestern Indiana, 10 in eastern Wisconsin, and 10 in western Michigan).

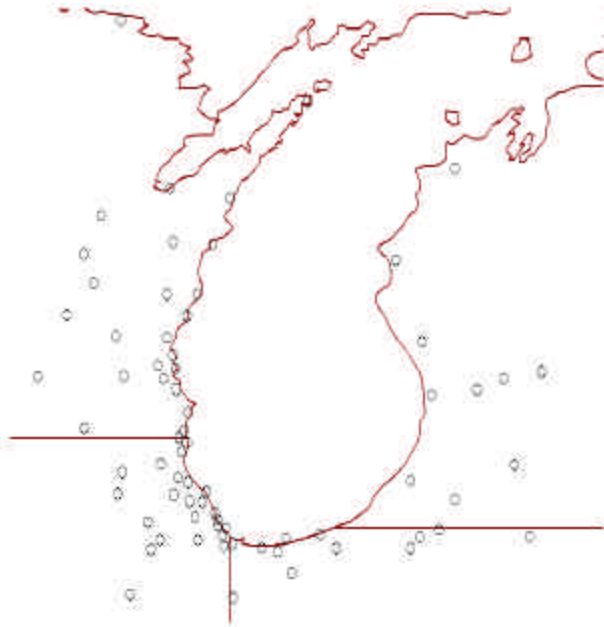


Figure 1. Ozone Monitors in the Lake Michigan Area

Ozone National Ambient Air Quality Standards (NAAQS): The 1-hour ozone NAAQS is 0.12 ppm. The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than 1 as determined by Appendix H (40 CFR Part 50.9). The attainment test specified in Appendix H states that the “expected number” of days with concentrations above 0.12 ppm (“exceedance” days) are to be estimated by calculating the average number of exceedance days during the most recent three years.

The “expected exceedance” form of the standard is intended to account for days with missing values. If a valid daily maximum 1-hour ozone value (i.e., based on at least 75% of the daylight hourly ozone values) is available for every day of the ozone season (see below), then the actual number of exceedances can be used to assess attainment/nonattainment. If a valid daily maximum 1-hour ozone value is not available for every day, then it will be necessary to account for missing values when estimating the number of exceedances.

Because ozone levels decrease significantly in the colder parts of the year in many areas, ozone is required to be monitored only during the “ozone season” as designated on a state-by-state basis. The ozone monitoring seasons for states in the Lake Michigan area are as follows:

<i>State</i>	<i>Begin Month</i>	<i>End Month</i>
Illinois	April	October
Indiana	April	September
Michigan	April	September
Wisconsin	April 15	October 15

To determine the amount by which the standard is exceeded, the design value must be calculated. The design value is defined as the concentration with expected number of exceedances per year equal to 1. The current USEPA design value method for ozone is simply to select the 4th highest daily maximum 1-hour value over the 3-year period. Thus, while an exceedance is defined as a peak daily 1-hour ozone value ≥ 0.12 ppm (or 125 ppb), a violation is defined as a design value ≥ 0.12 ppm (or 125 ppb).

Ozone Monitoring Data: The actual number of exceedances at each site for 1999, 2000, and 2001 are presented in Table 1. (For reference purposes, the number exceedances during the previous several years are also presented.) Based on this information, the number of monitors in violation of the 1-hour ozone NAAQS for the past five 3-year periods is as follows:

<i>3-Year Period</i>	<i>Sites in Violation</i>
1995 – 1997	11
1996 – 1998	7
1997 – 1999	6
1998 – 2000	2
1999 – 2001	0

During the period 1999 – 2001, there were 12 exceedance days. The number of exceedance sites and the peak daily values are provided below. Spatial maps of the daily maximum 1-hour ozone concentrations are provided in Figures 2(a) – (c).

<i>Year</i>	<i>Date</i>	<i>Number of Sites</i>	<i>Peak Value (ppb)</i>
1999	June 11	5	137
	July 16	2	130
	July 24	4	140
	July 30	5	161
	Sept 5	2	128
2000	June 9	3	130
	Aug 15	1	128
2001	June 13	1	125
	July 31	6	135
	Aug 1	1	125
	Aug 7	1	139
	Aug 8	2	134

Table 1. Actual Number of 1-Hour Exceedance Days

	1995	1996	1997	1998	1999	2000	2001		1995	1996	1997	1998	1999	2000	2001
ILLINOIS								MICHIGAN							
Zion	---	2	1	---	---	---	---	Frankfort	---	1	---	---	---	---	---
Waukegan	---	---	---	---	---	---	---	Scottville	3	2	---	---	1	1	1
Libertyville	---	---	---	---	---	---	---	Muskegon	4	1	---	---	1	1	---
Deerfield	---	---	---	---	---	---	---	Holland	4	1	---	---	1	1	1
Northbrook	---	---	---	---	---	---	---	Jenison	2	1	---	---	---	---	---
Cary	---	---	---	---	---	---	---	Grand Rapids	1	2	---	---	---	---	---
Elgin	---	---	---	---	---	---	---	Parnell/Evans	1	2	---	---	---	---	---
Des Plaines	---	1	---	---	---	---	---	Coloma	1	2	---	2	1	---	1
Evanston	2	---	---	1	---	---	---	Cassopolis	---	---	---	---	---	---	---
Chi-Truman	---	---	---	---	---	---	---	Kalamazoo	---	---	---	---	---	---	---
Chi-Taft	---	---	---	---	---	---	---								
Univ of Chi	2	---	---	---	---	---	---	WISCONSIN							
Chi-SE Police	2	---	---	---	---	---	---	Pleasant Prairie	4	2	1	2	2	---	1
MuseumSI					---	---	---	Kenosha	---	---	1	---	---	---	---
Chi-SWFP	2	---	1	---	---	---	---	Lake Geneva	---	---	---	---	---	---	---
Chi-Jardine	2	---	---	---	---	---	---	Racine	---	2	1	1	---	---	---
Alsip	1	---	---	---	---	---	---	S.Milw	2	---	2	---	1	---	1
Calumet City	1	---	---	---	---	---	---	Milw-Alverno	1	---	---	---	---	---	---
Cicero	---	---	---	---	---	---	---	UWM-N	---	1	1	---	1	---	1
S.Lockport	---	---	---	---	---	---	---	Milw-App.Ave	1	---	---	---	---	---	---
Lisle	---	---	---	---	---	---	---	Bayside	2	1	1	2	1	---	1
Lemont	---	---	---	---	---	---	---	Waukesha	---	---	---	---	---	---	---
Braidwood	---	---	---	---	---	---	---	Grafton	---	---	2	1	1	---	1
								Slinger	1	---	---	---	---	---	---
INDIANA								Harrington Beach	2	1	3	1	1	---	1
Laporte			1	---	1	---	---	Sheboygan	1	---	2	2	2	---	1
Michigan Cty	6	3	1	---	1	---	1	Manitowoc	1	2	2	1	1	---	---
Hammond	1	1	---	---	---	---	---	Kewaunee	1	---	1	---	---	---	---
Ogden Dunes	1	1	---	1	1	---	---	Newport Beach	1	1	2	---	---	---	1
Gary-IITRI	---	---	---	---	---	---	---	Milton	---	---	---	---	---	---	---
Lowell						---	---	Collins	1	---	1	---	---	---	---
Natl Lakeshore				1	1	---	---	Sheboygan Falls					---	---	---
Valparaiso				---	---	---	---	Milw-SE Hdqs					---	---	---

Figure 2(a). 1-Hour Exceedance Days During 1999

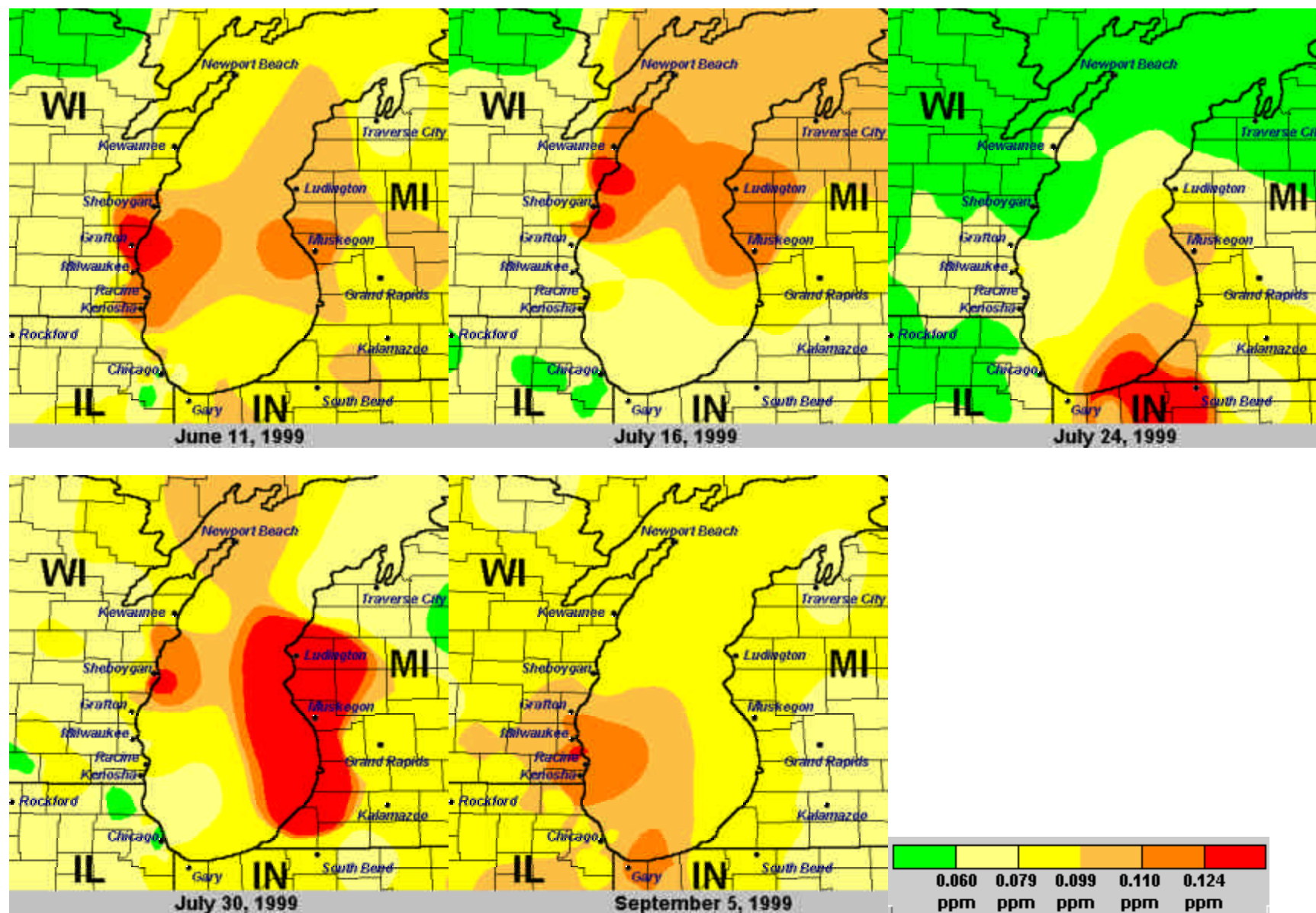


Figure 2(b). 1-Hour Exceedance Days During 2000

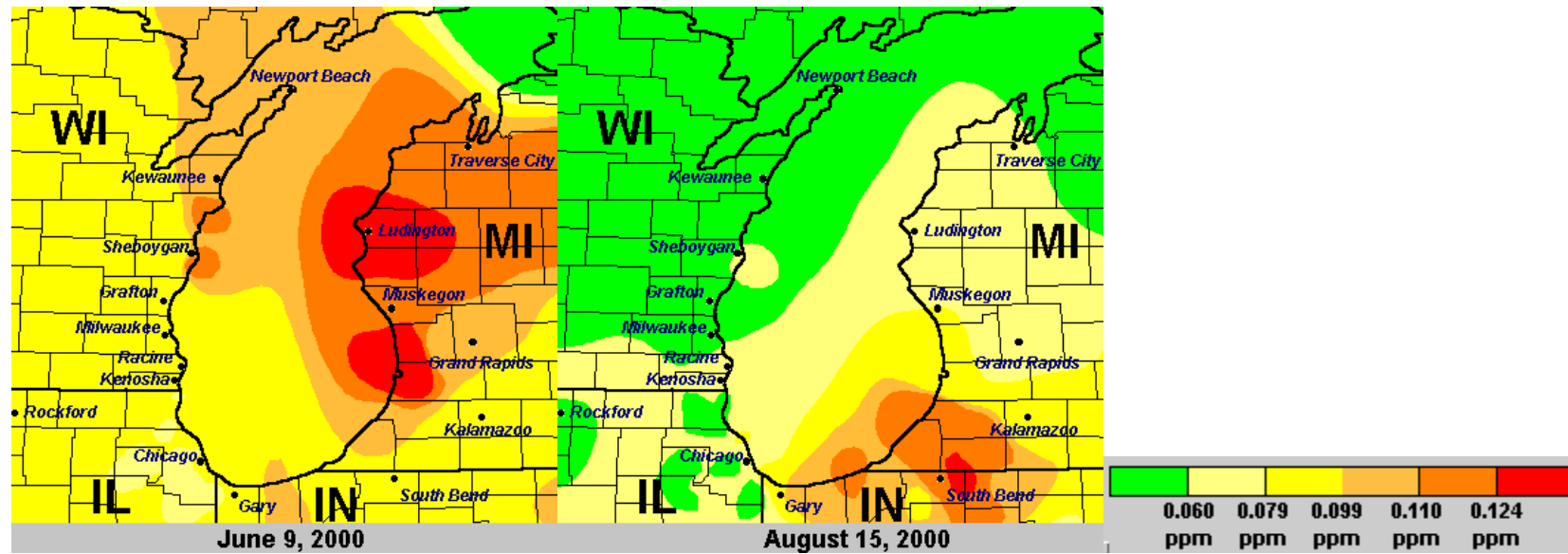
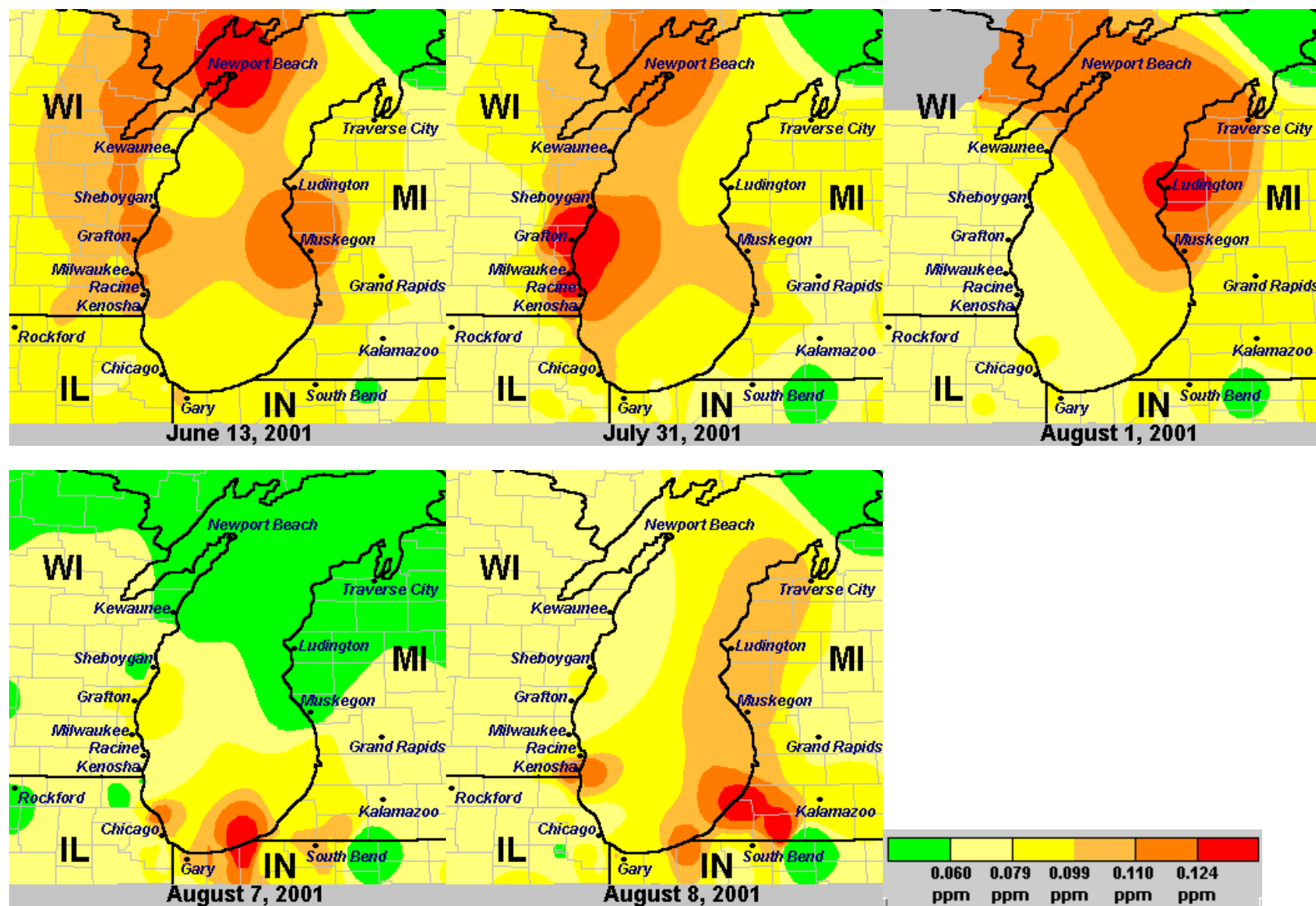


Figure 2(c). 1-Hour Exceedance Days During 2001



A Quick Look Summary Report from USEPA's AIRS data base with the monitor- and year-specific 1-hour ozone data is provided in Appendix A. This report shows:

- information about each monitoring site (Site ID and city/county/address of site);
- the year of data
- the number of actual measurements and the number of required measurements (to meet sampling criteria);
- the four highest daily 1-hour ozone concentrations; and
- the actual number of values and the estimated number of expected values above the ozone NAAQS, along with the number of missing days assumed to be less than the NAAQS (per 40 CFR Part 50, Appendix H).

Based on the estimated number of expected exceedances in the Quick Look Report, the sites with the highest average number of exceedances in each State over the period 1999 – 2001 are as follows:

<i>State</i>	<i>Site</i>	<i>Average Value</i>
Illinois	-----	0.0
Indiana	Michigan City	0.6
Michigan	Scottville	1.0
Wisconsin	Pleasant Prairie	1.0

The three highest design values in each State for the 1999 – 2001 period are presented in Figure 3 below.

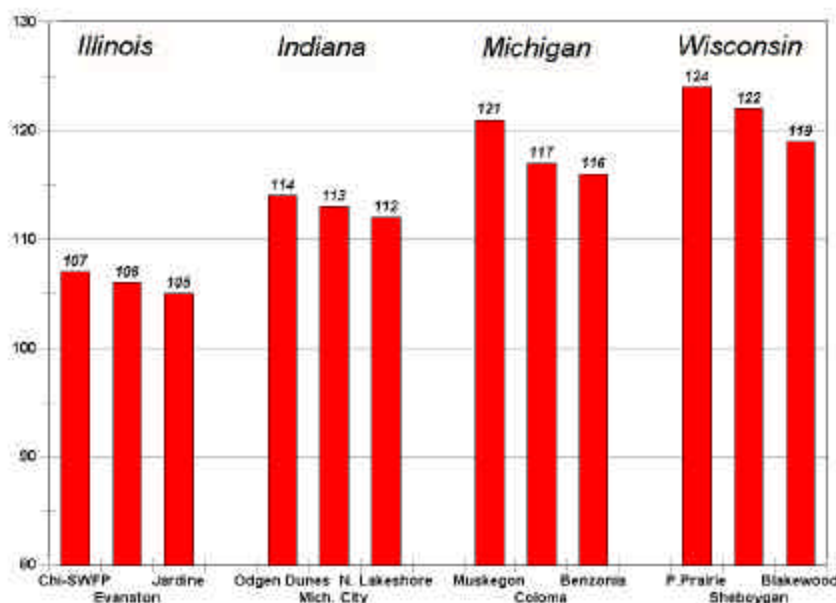


Figure 3. Design Values for Select Sites in the Lake Michigan Area

Additional Monitoring Data

Ozone data are available from other special purpose measurements: the Badger ferry, Sears Tower, and aircraft sampling. Even though these measurements cannot be used to assess attainment/nonattainment because they either do not meet data completeness criteria (i.e., need 75 percent of the daylight hours at a given location – see 40 CFR Part 50, Appendix H) or siting criteria (i.e., the sampling probe inlet must be located 3 to 15 meters above ground level – see 40 CFR Part 58, Appendix E), they do provide relevant information and should be considered.

Badger. The State of Wisconsin installed an ozone monitor on the Badger ferry in 1995. The purpose of these measurements is to provide ozone data over Lake Michigan near the surface. The ferry operates on the following schedule during the summer:

Schedule (4 hour crossing)			
Manitowoc, WI		Ludington, MI	
23:30 CST	→	3:30	
9:30	←	5:30	
12:00	→	16:00	
21:45	←	17:45	

During 1999 – 2001, 1-hour ozone concentrations above 125 ppb were measured on seven of the 12 exceedance days:

Year	Date	Hour(CST)	Value(ppb)
1999	Jun 11	1600	145
	Jul 15	1500	126
	Jul 16	1500	126
		1600	135
		1700	126
	Jul 30	1600	145
		1700	164
		1800	162
		1900	156
2000	Jun 9	1500	137
		1600	132
		1700	132
		1800	127
2001	Jun 13	1600	127
	Aug 1	1600	134

Many of these high values occurred when the ferry was located in the vicinity of the Michigan shoreline, indicating high ozone levels in western Michigan and likely southwesterly flow conditions. This is consistent with the spatial plots of the 1-hour exceedance days provided in Figures 2(a) – (c).

Sears Tower. The State of Illinois operates an ozone monitor on the 90th floor of the Sears Tower (approximate altitude 1200' AGL). The purpose of these measurements is to provide information about (incoming) background ozone levels. The measured values on the 12 exceedance days over the past three years are as follows:

<i>Year</i>	<i>Date</i>	<i>Sears Tower Peak Value (ppb)</i>	<i>Area-Wide Peak Value (ppb)</i>
1999	June 11	77	137
	July 16	64	130
	July 24	78	140
	July 30	68	161
	Sept 5	88	128
2000	June 9	72	130
	Aug 15	76	128
2001	June 13	84	125
	July 31	91	135
	Aug 1	67	125
	Aug 7	88	139
	Aug 8	65	134

These data indicate that elevated background levels occurred on most of the recent 1-hour ozone exceedance days.

Aircraft. The State of Wisconsin and a contractor for LADCO (R.B. Jacko & Associates) collect aloft ozone data with an aircraft. The purpose of these measurements is to provide information about the 3-dimensional ozone patterns in the Lake Michigan area. The flight patterns for the Wisconsin plane are shown in Figure 4. The Jacko plane flew along the boundary of the region and measured (incoming) background ozone levels. The sampling days for the period 1999 – 2001, and the peak measured ozone concentrations for the Wisconsin plane are as follows:

<i>Year</i>	<i>Date</i>	<i>WI Aircraft Peak Value (ppb)</i>	<i>Area-Wide Peak Value (ppb)</i>
1999	June 8	159	92
	June 9	175	118
	June 26	126	93
	June 27	85	113
	July 15	154	108
	July 16	152	130
2000	June 30	83	
	July 1	98	
	Aug 28	90	
	Aug 29	83	

	Aug 30	119	
2001	June 12	109	
	June 13	154	125
	June 14	133	
	June 18	107	
	June 25	127	
	June 26	135	
	June 27	145	
	June 28	154	
	Aug 6	142	
	Aug 7	120	139
	Aug 8	99	134
	Aug 9	64	
	Aug 17	64	
	Aug 20	56	

These data indicate that elevated ozone levels extend well above the surface in the Lake Michigan region.

Figure 4. Flight Patterns for Wisconsin Aircraft

